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Life Cycle Management in Developing Countries: State of the Art and Outlook

Guido Sonnemann[1*] **and Bas de Leeuw**[2]

[1] Programme Officer, Production and Consumption Branch, Division of Technology, Industry and Economics (DTIE),
[2] United Nations Environment Programme (UNEP), 39-43 quai André Citroen, 75739 Paris Cedex 15, France
Head, Strategy Unit, Production and Consumption Branch, Division of Technology, Industry and Economics (DTIE),
United Nations Environment Programme (UNEP), 39-43 quai André Citroen, 75739 Paris Cedex 15, France

* Corresponding author (guido.sonnemann@unep.fr)

Abstract

UNEP DTIE, through its Life Cycle Initiative, aims to enhance the skills of small and medium sized enterprises (SMEs) in developing countries on Life Cycle Management (LCM). This is part of its contribution to the 10-year framework of program on Sustainable Consumption and Production as a follow-up of the World Summit on Sustainable Development (2002). Apart from the potential of improving their environmental performance, life cycle thinking and the use of LCA can be a business opportunity for SMEs. The development of environmental management expertise may help them to position themselves as reliable suppliers. The Life Cycle Initiative has promoted and facilitated the establishment of regional life cycle networks, and UNEP has started a training program on LCM targeted at National Cleaner Production Centers (NCPCs) and other national institutes that are able to pass on the information to the target groups. Some multinational companies have started to provide capacity building on life cycle management for suppliers in developing countries. More companies could use this approach to help developing countries to tackle environmental requirements in the supply chain and thus the private sector may contribute significantly to eco-efficiency, cost savings and finding new markets for sustainable products and services in developing countries. Life cycle thinking applied to basic services such as water, waste and energy could be another way to directly contribute with life cycle management to human development.

1 Life Cycle Management

A product's life cycle begins with extracting raw materials from the ground and generating energy. Materials and energy are then part of manufacturing, transportation, use, and eventually recycling, reuse, or disposal. Life cycle thinking recognizes how individual choices influence what happens at each of these points so that trade-offs can be balanced to positively impact the economy, the environment, and society. Life cycle thinking helps to avoid decisions that address one environmental problem but cause another one and helps improving entire systems. Life Cycle Management (LCM) puts life cycle thinking into practice and has to address all three dimensions of sustainability: planet, people and profit. LCM is an internal management system which uses various tools such as Life Cycle Assessment (LCA) and Life Cycle Costing (LCC). It is applicable for business, industrial and other organizations which need a system-oriented platform for implementation of a preventive and sus-

tainability driven management approach. It may serve as a guiding principle for product oriented policy making and general policy frameworks such as Integrated Product Policy (IPP) and Extended Product Responsibility (EPR).

Overall, life cycle management leads to more sustainable patterns of consumption and production and helps to use limited financial and natural resources more effectively. Emerging related concepts such as function-based approach, product-service systems, and sustainable innovation have in common that the functional unit of products and services is no longer treated as a given, but as a starting point for innovation and 'thinking out of the box'. Using life-cycle thinking for systems of fulfillment of needs opens up largely unexplored territories for making radical progress in sustainable consumption and production. It opens up new areas of solutions, and it brings in new actors [1,2].

2 UNEP/ SETAC Life Cycle Initiative

UNEP and the Society of Environmental Toxicology and Chemistry (SETAC) launched the Life Cycle Initiative in 2002, after several years of preparation led by Jacqueline Aloisi de Larderel (UNEP) and Helias Udo de Haes (CML at Leiden University) [3].

The mission of the Life Cycle Initiative is to develop and disseminate practical tools for evaluating the opportunities, risks, and trade-offs, associated with products and services over their whole life cycle. The objectives of the Life Cycle Initiative are to:

- Collect and disseminate information on successful applications of life cycle thinking;
- Provide a basis for capacity building;
- Share knowledge about the interface between LCA and other tools;
- Identify best practice indicators and communication strategies for life cycle management;
- Expand the availability of sound LCA data and methods;
- Facilitate the use of life cycle based information and methods.

The managing board of the initiative is the International Life Cycle Panel (ILCP). The ILCP is assisted by the Secretariat situated at UNEP DTIE and guides the Executive Committee which is directed by Helias Udo de Haes [4]. The

initiative's website [5] has rapidly become a virtual meeting point and resource base for a large group of interested stakeholders, from business, research, government and civil communities around the world.

The three programs of the initiative aim at putting life cycle thinking into practice and at improving the supporting tools through better data and indicators. The Life Cycle Inventory program improves global access to transparent, high quality life cycle data. The Life Cycle Impact Assessment program increases the quality and global reach of life cycle indicators by promoting the exchange of views among experts whose work results in a set of widely accepted indicators. The Life Cycle Management program creates awareness and improves skills of decision-makers by providing information materials, establishing forums for sharing best practice, and carrying out training programs in all parts of the world.

The long-term deliverables of the Life Cycle Management program are:

- The integration of existing tools and concepts for decision-making on more sustainable products and services;
- Strategies for communication of life cycle information to relevant stakeholders;
- Training modules for SMEs and developing countries.

3 World Summit on Sustainable Development and Follow-up

The Plan of Implementation agreed upon at the World Summit on Sustainable Development in Johannesburg (2002) calls for a 10-year framework of programs to support regional and national initiatives to accelerate the shift towards sustainable patterns of consumption and production. We must "…develop production and consumption policies to improve the products and services provided, while reducing environmental and health impacts, using, where appropriate, science-based approaches, such as life cycle analysis." Another important recommendation is the "increase (of) eco-efficiency, with financial support from all sources, where mutually agreed, for capacity-building, technology transfer and exchange of technology with developing countries and countries with economies in transition, in co-operation with relevant international organizations" [6].

The World Summit's call for a life cycle approach, capacity building and private-public partnerships for changing unsustainable patterns of consumption and production reflects the realization that environmental gains that have been made in production efficiency may be overtaken by the overall increase in the demand for products and services (rebound effect). This should be tackled through an integrated approach, for which the life-cycle approach provides the basic concept.

The 10-year framework is being coordinated by UNEP DTIE, in co-operation with the secretariat of the Commission for Sustainable Development (UN DESA) [7]. UNEP DTIE has assisted environmentally sound technology transfer and product choices through information exchange, capacity building, and the development of sound environmental management procedures. Several training sessions were delivered together with InWEnt, Germany's capacity building organization, through the existing UNEP/ UNIDO global network of National Cleaner Production Centers (NCPCs). Life cy-

cle based tools were introduced as approaches that connect cleaner production and sustainable consumption [8].

4 Need for Capacity Building

Feedback from participants of the training courses on sustainable consumption and production has confirmed a need for more capacity building on these tools, including tools for improving the environmental performance of companies in the global supply chain. It was also confirmed by earlier work, including the 'Towards the Global Use of Life Cycle Assessment' project, which included a UNEP workshop, held in San Francisco and chaired by Helias Udo de Haes [9], and the more recent user needs survey of the Life Cycle Initiative [10].

In particular it is important to strengthen the capacity of the weakest economic actors in the global supply chain to tackle environmental requirements. Therefore, SMEs and local authorities in developing countries are seen as the crucial target groups in capacity building efforts.

Multinational companies are increasingly greening their supply chain. In this way they establish environmental requirements that SMEs in developing countries have to meet if they want to be part of these supply chains. Capacity on the tools to improve and communicate environmental performance in the supply chain will provide these companies in developing countries with new business opportunities. It will avoid competitive disadvantages that may occur from environmental benchmarking. Capacity building and technology transfer on environmental management thus allow SMEs to position themselves as reliable suppliers to leading companies. Capacity building supports at the same time the goals of sustainable development: to eradicate poverty and to decouple economic growth from environmental degradation.

SMEs need appropriate support to enable and ensure a continuous application of the gained knowledge. However, local and national authorities in developing countries have often an even stronger lack of technical knowledge on life cycle based tools as SMEs. So capacity also needs to be built in the public sector, not only in the private sector.

5 UNEP Strategy on LCM for Developing Countries

UNEP DTIE has started various activities with several stakeholders to strengthen the capacity of developing countries on life cycle thinking. The aim is to promote life cycle management as an element of economic development in developing countries in order to contribute to sustainable consumption and production.

Capacity building on life cycle thinking and technology transfer that takes this concept into account should be applied to the delivery of basic services such as water, waste and energy. In this way, Life Cycle Management may directly contribute to human development in lot of countries.

The specific objective is strengthening the capacity of SMEs and local authorities in developing countries to deal with environmental requirements in the supply chain by way of training, and conducting pilot projects and technology transfer. The participation of business and industry, of technology and research centres is crucial in this undertaking.

The establishment of an enabling policy framework is another key requirement for capacity building. National and local authorities transfer the acquired knowledge from the training processes to policies. UNEP encourages the development of local training s and follow-up projects promoting life cycle based tools as additional methods for achieving a long-term impact. The Life Cycle Initiative will prepare adequate awareness-raising material to stimulate this market, and UNEP plans to run country specific pilot projects after a first training phase so that the gained knowledge is directly implemented.

6 First Steps Undertaken by the Life Cycle Initiative

The capacity building process in the Life Cycle Initiative has started with providing general links to available material on the initiative website [5] and the identification of specific training needs in the target countries. At an early stage, the International Journal of Life Cycle Assessment offered special subscription rates to working group members of the UNEP/ SETAC Life Cycle Initiative with a rate of 75% discount applicable to non-OECD countries. Then, at the end of 2004, the ILCP asked the Executive Committee to prepare training material on LCA and LCM in the form of modular training kits, downloadable on the web. The idea is that these kits are first applied in 'training of trainers' sessions, before being used by the 'trainers trained' for a broader audience, creating in this way slowly a market. The training process has to be accompanied by a consistent feedback and monitoring procedure.

Another idea that was developed is the coaching of the trainers and pilot projects in developing countries through mentors from the Life Cycle Initiative whose role it is to provide additional support. This model has been first established by the Task Force on Life Cycle Inventory (LCI) databases and capacity building that works with participating countries, encouraging them to share experiences and data in the surrounding countries of the target region. In close co-operation with this task force the initiative website was updated by using a multi-language Information System (IS) management tool to assist the transfer of Environmentally Sound Technologies (EST), which was developed by UNEP [11]. Through ESTIS, the initiative website provides now a decentralized IT network with improved access and local control for life cycle related information transfer.

First events in co-operation with the Life Cycle Initiative focusing on capacity building took place from October 2004 to September 2005 in Japan, Costa Rica and Kenya for the three global regions Asia/ Pacific, Latin America and Africa. A further contribution to the LCA capacity building efforts was initiated with leading LCA software and database providers through developing ideas for schemes of free licenses to support 'environment for development' projects.

7 Regional life Cycle Networks

In connection with the above mentioned meetings, regional life cycle networks for Africa, Latin America and Southeast Asia (including China and India) were created and strengthened. The regional networks collaborate with the Life Cycle Initiative as part of the capacity building activities in the initiative. In their further development, these networks are encouraged to establish close linkages with the NCPC network and the regional programs on sustainable consumption and production as well as the emerging SETAC regional branches in order to make them visible to industry and governments.

Africa. The African LCA Network (ALCANet) [12] has identified a set of actions and initiatives that it will pursue in the coming years:

- Survey and outreach to introduce LCA and ALCANet to stakeholders in the region;
- Linkage of ALCANet to the National Cleaner Production Centers and eco-design efforts in Africa;
- Involvement in and contribution to the Task Forces of the Life Cycle Initiative;
- Organization of LCA awareness-raising and/or training workshops for policy-makers;
- Development of life cycle inventory data and a list of priority impact categories for Africa and its regions, and to identify the available methods for life cycle impact assessment for each of these categories;
- Capture of traditional knowledge on environmental and resource management.

Brainstorming and planning meetings to identify these topics were held in conjunction with the Third African Roundtable on Sustainable Consumption and Production (ARSCP) in Casablanca, Morocco, 17–20 May 2004 and the 1st African Symposium and Training of Trainers Workshop on Life Cycle Assessment at UNEP Headquarters, Nairobi, Kenya from 29 August to 2 September 2005.

Latin America. Several experts on life cycle approaches in Latin America have established the Latin American Life Cycle Network [12] and the Asociación de LCA en Latinoamérica (ALCALA) with the general objective of promoting the application of LCA and the concept of Life Cycle Thinking in the practices of sustainable material management in Latin America. Specific aims are raising awareness on LCA and life cycle thinking in Latin America through courses and seminars, exchange of information on conditions for the successful application of life cycle approaches, and stimulating the involvement of Latin American countries in the Life Cycle Initiative.

As a first outcome of this network, it is proposed to integrate existing knowledge through the exchange of existing information within the countries of Latin America and the preparation of education material in the following sectors:

- Mining;
- Mineral extraction and metal production;
- Generation of hydroelectric and thermal energy.

This will provide the possibility to carry out projects in two or more countries, to discuss and disseminate the information, and to prepare the creation of a future Latin American Life Cycle Inventory database.

The experts met at the International Conference on Life Cycle Assessment (CILCA) 2005, held in San Jose, Costa Rica on 25–28 April. This was the first time ever that such a conference was convened in Latin America.

Southeast Asia. The Southeast Asian Life Cycle network (SEAsia LCA.net) identified the following major activities:

- Development of Organization Structure;
- Communication activities and for the network;
- Training activities both for LCA users and LCA trainers;
- LCI data development for various countries;
- Life cycle impact assessment method development for the region.

SEAsia LCA.net is a loose, informal network consisting of various country focal points. Its mission is to support capability development among Southeast Asian member economies. Japan is in an advisory role, India has taken over the communication role (website).

The network discussed indicators of success. The success of activities on LCA capacity building may be measured by the number of LCA practitioners in different target groups, number of trainees, number of downloads in the case of using the Internet, as one of the dissemination means.

The SEAsia LCA.net was constituted at the 4th AIST Workshop on LCA for APEC Member Economies that was held in Tsukuba, Japan, on 26–27 October 2004 [13].

8 Strengthening the Focus on LCM and Potential Linkages

The focus of attention of the above mentioned meetings and networks is on LCA. To become relevant for developing countries it is necessary to focus on the application of LCA and life cycle thinking, which in practice means: on LCM. The LCM training material will have to foster the organization of training events that promote life cycle thinking in a broader sense. First pilot projects will be carried out that demonstrate the added value of using the life cycle approach in developing countries in practice.

Co-operation with additional actors will be helpful:

- Cleaner Production Centers that are often part of the UNEP/ UNIDO global network of NCPCs could be used as multipliers to reach certain SMEs and local authorities.
- The UN Global Compact Initiative seeks to advance responsible corporate citizenship so that business can be part of the solution to the challenges of globalization. In this way, the private sector can help realize the UN Secretary-General's vision: a more sustainable and inclusive global economy.
- Some multinational companies have accompanied their environmental requirements for greening the supply chain with information and training of suppliers. By joining with UNEP they will be able to expand the effectiveness of their outreach and also gain greater visibility for their environmental policies.

The outlined strategy can only be implemented successfully with the support of stakeholders interested in the topic. UNEP DTIE, through its Life Cycle Initiative stands for an inclusive way to create capacity and transfer technology where it is needed. Multinationals are in regular business relationship with many SMEs in developing countries, and thus they are in a perfect position to be a driver for comprehensive LCM training in emerging economies.

9 Conclusions

Above, a UNEP strategy to promote LCM in developing countries has been presented that is to be implemented through the Life Cycle Initiative and the ten-year framework on sustainable consumption and production. The strategy aims at strengthening the capacity of the weakest economic actors in the global supply chains to tackle environmental requirements. Two particularly important target groups are SMEs and local authorities. These capacity building efforts would benefit from new partnerships with industry and other organizations, such as the Global Compact and the NCPC network. The World Summit on Sustainable Development (2002) has called for capacity building and public-private partnerships for changing unsustainable patterns of consumption and production. The Life Cycle Initiative has undertaken some first steps in this capacity building process. In particular, regional life cycle networks in Africa, Latin America and Southeast Asia have become essential actors in the promotion of life-cycle based tools in the developing world. However, a stronger focus on applications of life cycle approaches is necessary to really make a difference and initiate changes in unsustainable patterns of consumption and production. Therefore, LCM training which takes into account all dimensions of sustainability is needed, and pilot projects have to be identified and replicated on a wider scale. Large corporations have an essential role to play in this endeavor due to their concrete power over the SMEs in their supply chains and the money they have available to implement training.

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